

WHAT IS CLAIMED IS:

1. A digital watermark embedding method of embedding watermark information in an image signal, comprising:

5 extracting a specific frequency component signal from the input image signal;

 controlling at least one of a phase and amplitude of the specific frequency component signal in accordance with the watermark information; and

10 outputting an image signal embedded with the watermark information by superposing the specific frequency component signal, at least one of the phase and amplitude of which has been controlled, on the input image signal.

15 2. The digital watermark embedding method according to claim 1, further comprising limiting an amplitude of the specific frequency signal.

 3. The digital watermark embedding method according to claim 1, wherein extraction of the specific frequency component signal is randomized.

20 4. The digital watermark embedding method according to claim 1, wherein outputting the image signal comprises subjecting the specific frequency component signal, at least one of the phase and
25 amplitude of which has been controlled, to a nonlinear process, and superposing the specific frequency component signal processed on the image input signal.

5. A digital watermark detection method comprising:

extracting a specific frequency component signal from an input image signal in which watermark information is embedded;

controlling at least one of a phase and amplitude of the specific frequency component signal extracted, to obtain a controlled specific frequency component signal; and

performing a correlation operation between the controlled specific frequency component signal and the input image signal to extract the watermark information.

6. The digital watermark detection method according to claim 5, further comprising limiting an amplitude of the specific frequency signal.

7. The digital watermark detection method according to claim 5, further comprising randomizing the specific frequency component signal extracted.

8. The digital watermark detection method according to claim 5, wherein performing the correlation comprises subjecting the controlled specific frequency component signal to a nonlinear process, and performing the correlation operation between the image input signal and the controlled specific frequency component signal subjected to the nonlinear process.

9. A digital watermark embedding apparatus which embeds watermark information in an input image signal, comprising:

an extraction unit configured to extract
5 a specific frequency component signal from the input image signal;

a control unit configured to control at least one of a phase and amplitude of the extracted specific frequency component signal in accordance with the
10 watermark information; and

a superposing unit configured to superpose the specific frequency component signal, at least one of the phase and amplitude of which has been controlled by the control unit, on the input image signal to output
15 an image signal embedded with the watermark information.

10. The digital watermark embedding apparatus according to claim 9, further comprising an amplitude limiter which is inserted between the extraction unit and the superposing unit and limits an amplitude of
20 the specific frequency signal.

11. The digital watermark embedding apparatus according to claim 9, wherein a characteristic of at least one of the extraction unit and the control unit
25 is randomized using randomizing information.

12. The digital watermark embedding apparatus according to claim 9, further comprising a nonlinear

filter inserted between the control unit and the superposing unit.

13. A digital watermark detection apparatus which detects watermark information embedded in an input
5 image signal, comprising:

an extraction unit configured to extract a specific frequency component signal from the input image signal;

a control unit configured to control at least one
10 of a phase and amplitude of the specific frequency component signal extracted; and

a correlation computing unit configured to perform a correlation operation between the specific frequency component signal, at least one of the phase and
15 amplitude of which has been controlled by the control unit, and the input image signal, to extract the watermark information.

14. The digital watermark detection apparatus according to claim 13, further comprising an amplitude
20 limiter which is inserted between the extraction unit and the correlation computing unit and limits an amplitude of the specific frequency signal.

15. The digital watermark detection apparatus according to claim 13, wherein a characteristic of at
25 least one of the extraction unit and the control unit is randomized using randomizing information.

16. The digital watermark detection apparatus

according to claim 13, further comprising a nonlinear filter inserted between the control unit and the correlation computing unit.

17. A digital watermark embedding apparatus
5 comprising:

extraction means for extracting a specific frequency component signal from an input image signal;

control means for controlling at least one of a phase and amplitude of the extracted specific frequency
10 component signal in accordance with watermark information; and

superposing means for superposing the specific frequency component signal, at least one of the phase and amplitude of which has been controlled by the
15 control means, on the input image signal so as to output an image signal embedded with the watermark information.

18. A digital watermark embedding apparatus according to claim 9, further comprising an amplitude
20 limiter which is inserted between the extraction means and the superposing means and limits an amplitude of the specific frequency signal.

19. A digital watermark embedding apparatus according to claim 9, further comprising a nonlinear
25 filter inserted between the control means and the superposing means.

20. A digital watermark detection apparatus

comprising:

extraction means for extracting a specific frequency component signal from an input image signal in which watermark information is embedded;

5 control means for controlling at least one of a phase and amplitude of the extracted specific frequency component signal; and

correlation computing means for performing a correlation operation between the specific frequency
10 component signal, at least one of the phase and amplitude of which has been controlled by the control means, and the input image signal, to extract the watermark information.